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NEW HIGH-END STARS

Constellation's State-of-the-Art Electronics

An Unprecedented Assault on the State of the Art

Constellation Audio Altair Preamplifier and Hercules Power Amplifier

Robert Harley

High-end audio products are often the realization of one person's singular vision. The designer conceives of the product, designs the circuits, builds prototypes, and puts his personal stamp on the result by voicing it to reflect his own sonic taste. To this designer, any outside influence is anathema. This approach embodies the audio equivalent of Stanley Kubrick's dictum: "One man writes a novel. One man composes a symphony. It is essential that one man make a movie."

Another school of thought, however, suggests that the best audio products are designed not by a lone wolf but by an assemblage of engineers, each of whom brings specialized expertise to bear on the challenge. Not only does the product benefit from a wider array of experience and ideas, but its sonic character is less likely to reflect just one person's priorities.

The new Altair preamplifier and Hercules monoblock power amplifiers from Constellation Audio epitomize the group-design approach. These breathtakingly ambitious and breathtakingly expensive products were created by a team of designers, each of whom has a long history of distinguished contributions to high-end audio. The idea behind these electronics was to assemble the world's best talents and give them *carte blanche* in terms of virtually unlimited cost and unlimited development time. The mandate from Constellation's founders (the Australians who brought us the Continuum turntable) to this *Who's Who* of high-end designers was: "Create your best work with no commercial constraints." That list of contributors includes, among others, John Curl, Bascom King, Demian Martin, and James Bongiorno, all led by industry veteran Peter Madnick. This approach explains the name Constellation Audio—a grouping of stars, indeed.

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The first products to emerge from this audacious and unprecedented undertaking are the $60,000 Altair preamplifier and $140,000-per-pair Hercules monoblock power amplifiers. (The Orion phonostage and Sirius disc player/music server were not shipping at the time of this review.) Constellation Audio recently showed a line of electronics scaled-down in execution and price, but the company needed to first design and build these cost-no-object assaults on the state of the art.

The Altair linestage preamplifier and Hercules power amplifiers make a strong and potentially polarizing visual statement. They not only break new ground in industrial design, they also push the boundaries of the high-end audio aesthetic.

ALTAIR PREAMPLIFIER AND PYXIS CONTROLLER

The Altair is a two-chassis affair (power supply and linestage electronics), with each chassis apparently carved out of solid blocks of aluminum. The linestage chassis was, indeed, carved from aluminum blocks, and the power supply assembled from thick, milled-aluminum panels. The linestage's two chassis halves are fitted together in a clamshell configuration separated by an air-tight narrow black gasket.

Together the linestage and its power supply weigh in at a whopping 90 pounds. Eight inputs are provided, four balanced on XLR jacks and four unbalanced on RCA jacks. Line output is available on both balanced and unbalanced jacks, as are the record outputs.

As you'll see in the technology sidebar, the Altair's design and construction are unlike that of any other linestage extant. From the volume control to the vibration-isolation measures, the Altair pushes unto uncharted territory.

The Altair has no apparent front-panel controls, markings, or indicator lights on either chassis. With the Altair in front of me for the first time, I felt like the proto-human (and Dr. Heywood Floyd) contemplating the monolith in *2001: A Space Odyssey* ("Its origin and purpose still a total mystery."). How do I turn it on? Switch sources? Adjust volume?

Just as the Altair and Hercules feature avant-garde industrial design, these electronics introduce a new paradigm in system control. Rather than looking to the preamplifier chassis for system adjustments or information on system status (selected input, volume, etc.), Constellation has moved these functions to a hand-held device that I hesitate to call a "remote control." This device is so far removed from a conventional remote that Constellation has given it a name—Pyxis—to signify its status as a full component in the Constellation line. Pyxis controls not just the Altair, but every Constellation component in your system.

Pyxis settles in between your two hands like an extension of your body. The look and feel of Pyxis is commensurate with the asking price of these electronics. The front face and dual knobs, made from aluminum, have a slightly textured surface that just feels perfect. The sides and back are clad in rich leather, hand-tooled by a woman who once made purses for Hermès. Between the two knobs is a large touchscreen display that shows you everything you could want to know about the system, from the volume setting, to the selected input, to the operating temperature of the power amplifiers. The screens are "context sensitive": They change depending on the function you are performing. The primary display when listening shows you the volume as a number, with the right knob adjusting the level and the left knob fine-tuning the balance. The volume steps change with the signal level; from 0 to –30dB the steps are 0.1dB, from –30dB to –60dB the steps are 0.5dB, and below –60dB the volume resolution is 1dB. The balance display is a graphical representation showing deviation from the center position, in 0.1dB increments. I find a volume knob next to a numerical display preferable to an up/down pair of buttons with no display, or a display on a preamplifier chassis across the room. Five "hard" buttons (more like rectangular bars) beneath the display turn on and off the system mute and absolute polarity switches, and allow navigation between the various screens. From Pyxis you can, for examples, name the inputs, set the minimum and maximum gains for each input independently, and perform other housekeeping functions.

When you add a Constellation component to the system, Pyxis recognizes that fact and supplies control functions specific to that product. For example, my system did not have the Orion phonostage, so Pyxis showed no phonostage controls. But add the Orion phonostage and Pyxis will display—and allow you to adjust—phono gain and loading. If you have a Sirius disc player/music server, Pyxis will display metadata such as track name and artist. A future upgrade allows Pyxis to operate as a "learning remote" that will store control commands for other brands of electronics through an IR input/output on its top panel. Pyxis' software can be updated via a rear-panel computer connection.

The settings and values displayed on Pyxis do not originate in Pyxis itself; rather, Pyxis sends commands to components in the system by RF, which in turn send status data back to Pyxis for display. Because it operates on RF signals (2.4GHz 802.15.4) rather than IR, there's no need to point the Pyxis toward a component. A small box, called the Pulsar Hub, sits behind your rack to receive and transmit RF signals. In fact, this device is essentially a router that communicates with all the Constellation components, as well as sending and receiving data from Pyxis.

As you might imagine, Pyxis consumes a fair amount of power, requiring you to leave it on the charging cradle when not in use. This point brings me to my only complaint about the operation of these electronics; the wall-wart power supply that plugs into the charging cradle is an off-the-shelf device whose plug didn't make good contact with the charging cradle, leaving me with a dead battery on occasion. I had to wiggle the plug in the charging cradle to find just the right point where it made contact—and then be careful not to bump it. For $60k, you should expect no such glitches. The factory is aware of this problem and is using a new connector on current production. I must also report that the first review sample had a number of problems, including Pyxis locking up, which rendered the Altair unresponsive to control via the front-panel buttons. This was resolved by replacing both units. The first review sample was, however, a "test mule" that had been used during development, and later dragged all over the world to shows and dealer events. Once these issues were resolved, operating the system through Pyxis was a delight.

Although apparently devoid of controls or indicators, the Altair's chassis hides a row of buttons and an LED under the top surface of a gentle inset curve. The LED changes colors

The Altair's design and construction are unlike that of any other linestage.

or flashes to indicate power status and mute, while the row of buttons provides basic controls such as power on/off, source switching, volume, and mute. These buttons are tiny and not marked, so unless you become familiar with their operation or consult the owner's manual, stick with the Pyxis.

HERCULES POWER AMPLIFIER

The Hercules power amplifiers are just as radical in conception, design, and execution as the Altair and Pyxis. These are by far the largest, most powerful, and most expensive amplifiers I've reviewed. The sheer mass of these gargantuan towers of sculpted aluminum is cleverly minimized by a slight narrowing at the bottom of the chassis and strategically placed curves. The amplifier's sides are sheathed in plates through which large holes have been drilled to dissipate the Hercules' considerable heat output. Weighing in at 270 pounds each and measuring 11.75" x 29" x 20.25", the Hercules dwarfs even as imposing an amplifier as the Mark Levinson No.53.

These massive vertical amplifiers are rated to deliver 1000W into 8 ohms, 1500W into 4 ohms, and 2000W into 2 ohms. This power is available, however, provided that your electrical supply can deliver enough current through the wall outlet. To achieve ultimate rated output power, you must use one 20-amp outlet for each amplifier. I ran the pair of Hercules from the same 15A circuit for the review with no apparent performance limitations. For all intents and purposes, the Hercules' output power is essentially unlimited.

As with the Altair, the Hercules' front panel is minimalist, with just a long, thin LED in the middle where the two chassis halves meet. This LED changes color and flashes to indicate the amplifier's status. The rear panel has a small touchscreen display that shows the operating status, heatsink temperature, output power (peak and RMS) at any given moment, hours of use, and any overload conditions. The touchscreen also allows you to mute the amplifier, such as when changing cables. The information displayed on the Hercules' rear-panel touchscreen will appear on Pyxis' touchscreen, obviating the need to look behind the amplifier.

Input is via balanced or unbalanced jacks, but with a twist. Two pairs of balanced inputs are provided, one marked "Constellation Direct." This is the preferred input when driving Hercules with a Constellation linestage because it bypasses Hercules' input stage, connecting the linestage's output directly to the power amplifier's driver stage. The second balanced input, provided for connection to the linestages of other brands, routes the signal through a line amplifier (with identical topology to that in the Altair) that ensures that the two halves of the balanced signal are perfectly gain-matched.

The Hercules, along with the entire line of Constellation electronics, is built in Newbury Park, California, just north of Los Angeles.

(See the sidebar for the technical details of the design and build.)

LISTENING

I was fortunate enough to have listened to the Altair and Hercules with three world-class loudspeakers, the $97,500 Rockport Altair (no relation to Constellation's Altair), Sonus faber's $200k "The Sonus faber," and the $70k TAD Reference One. Each loudspeaker revealed a different aspect of these remarkable electronics, and I suspect that I would have discovered even more with each new loudspeaker.

SPECS & PRICING

Altair Linestage
Inputs: Four balanced on XLR jacks, four unbalanced on RCA jacks
Outputs: Two balanced on XLR jacks, two unbalanced on RCA jacks (both main outputs), one record output on XLR jacks, one record output on RCA jacks
Input impedance: 200k ohms balanced, 400k ohms unbalanced
Output impedance: <50 ohms
Volume control resolution: 0.1dB, 0.5dB, 1dB (level-dependent)
Weight: 68 lbs. (linestage), 22 lbs. (power supply)
Dimensions: 17.5" x 5.53" x 14.82" (linestage); 17.5" x 2.82" x 14.5" (power supply)
Price: $60,000

Hercules Power Amplifier
Output power: 1000W into 8 ohms, 1500W into 4 ohms, 2000W into 2 ohms (1kHz, 1%THD);
Gain: 32dB
Input impedance: 100k ohms unbalanced, 200k ohms balanced
Output impedance: 0.05 ohms
Inputs: Two balanced on XLR, one unbalanced on RCA
Weight: 275 lbs. each, net
Dimension: 11.75" x 29" x 20.25"
Price: $70,000 each

Pyxis System Controller
Screen resolution: 432 x 230 pixels
Controls: Volume knob, multifunction digital encoder knob, five multifunction buttons, backlit touchscreen
Batteries: Four rechargeable NiMH AAA
Dimensions: 8.25" x 2.75" x 2" (Pyxis); 10" x 0.92" x 3.2" (charging cradle)
Price: Included with the Altair linestage, Orion phonostage, or Sirius disc player/music server (one per system)

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ASSOCIATED COMPONENTS
BAlabo BC-1 Mk-II preamplifier and BP-1 Mk-II amplifier, Mark Levinson N°53 power amplifiers; Meridian 808.3 and Meridian Sooloos system (Ethernet connected), dCS Puccini/U-Clock, and Berkeley Audio Design Alpha DAC, custom fanless and driveless PC server with Lynx AES16 card; iMac server with Berkeley Alpha USB interface; Basis Inspiration turntable with Basis Vector 4 tonearm, Air Tight PC-1 Supreme cartridge; Aesthetix Rhea Signature phonostage; Shunyata V-Ray V2 and Audience aR-6TS power conditioners; Shunyata CX-series AC cords; Transparent XL Reference interconnects; Transparent XL Reference loudspeaker cables; Billy Bags equipment racks, ASC 16" Full-Round Tube Traps

Before getting to the listening impressions, a few operational notes. I mounted the Hercules amplifiers on a pair of small platforms custom made by Peter Madnick. This mounting prevented the amplifiers from sinking into the carpet and potentially interfering with the convection cooling. The platforms also made the amplifiers more stable physically. They should be standard issue with every pair of Hercules. Second, these amplifiers take a long time to reach their optimum operating temperature, which you can hear as a gradually increasing sweetness over the first two hours (less when playing music at high level or with low-sensitivity loudspeakers). Third, once they reach thermal equilibrium, the pair of Hercules put out an enormous amount of heat. The chassis get almost too warm to touch for an extended period, and the chassis are huge. The output stage is heavily biased, which allows Hercules to deliver a substantial portion of its 1000W rating in Class-A operation.

But when these electronics have settled in and are in full song, there's absolutely nothing like them in my experience. I'll cut to the chase: The Altair and Hercules set new standards in transparency, resolution, absence of grain, and sheer sense of realism.

The first thing I noticed, and what struck me every time I returned to these electronics, was the almost eerie palpability of instruments, both in their timbre and spatial presentation. This impression was fostered by four sonic qualities that combined synergistically to produce a signal of astonishing musical realism—transparency, resolution, timbral liquidity, and an absolutely jet-black background. Starting with transparency, the Constellation electronics seemed to strip away a fine gray scrim between the musicians and me. The sense of clarity, presence, and immediacy was startling with this layer removed. An analogy comes to mind of diving off a coral reef in water of 150-feet visibility on a sunny day. Not only does the sunlight penetrate the water and illuminate the scene, but the water's crystal clarity makes the colors and shapes of the coral and multi-hued fish vivid and vibrant. That's how the Altair and Hercules presented instrumental and vocal images—three-dimensional images in an utterly transparent three-dimensional space. This transparency not only fostered greater immediacy of images at the front of the stage, but also provided an unobstructed view into the very back of the soundstage. This quality, coupled with the tremendous portrayal of depth, produced a staggeringly realistic soundstage.

In this presence of instruments at the front of the stage, the Altair and Hercules reminded me of a single-ended triode amplifier. SETs have a palpability and directness of communication in the midrange that brings vocalists to life and imbues instrumental timbres with an addictive immediacy. The Constellation electronics had a similar presentation, along with a timbral warmth and liquidity in the mids and treble that was also reminiscent of single-ended amplifiers. I heard a complete absence of grain and electronic haze overlaying instrumental textures. The presentation had a "cleanliness" without being clinical. Moreover, the upper-midrange and treble were extremely open and airy, with a sense of unlimited treble extension in the top octave. The treble struck a beautiful balance, sounding simultaneously lively and sweet.

Some of this palpability of instrumental images was the result of the extremely high resolution. Familiar recordings suddenly had greater density of information, particularly the kind of information that conveys realism. On the disc *Skip, Hop & Wobble* by Jerry Douglas, Russ Barenberg, and Edgar Myer, I could hear more texture and detail in the acoustic guitar and dobro, along with sounds such as the fingers moving over the strings. The presentation was just more nuanced, finely filigreed, and richly detailed, which contributed to the feeling of hearing musicians performing in front of me. Some electronics that are very high in resolution can sound "cold" and a little threadbare in timbre. They can also resolve information in a way that's not particularly musical, producing a presentation that hits the audiophile buttons but fails to connect musically. The Altair and Hercules are decidedly not in that category. Rather, their resolution of detail sounded completely organic, un-hyped, and added greatly to musical involvement.

This resolution was aided by another of these electronics' great strengths, the astonishingly quiet background. It's interesting how what I thought was a black background in other electronics was actually a slightly gray pall by comparison with the Altair and Hercules. The Constellation electronics easily set a new standard in their dead-quiet noise floor. It's not that you hear this noise as noise in other electronics, but rather as a slight dilution of musical realism. When instruments and voices are projected against this jet-black backdrop, the sense of musical drama unfolding is heightened. The black background not only creates a greater sense of music-making, it also allows the finest details to be resolved with their timbres and micro-dynamics intact. Low-level sounds become more identifiable and less like undifferentiated noises that don't seem integrated into the presentation or musically relevant. But when portrayed with the kind of richness and filigree realized by the Altair and Hercules, and against a perfectly quiet background, these details suddenly seem an indispensable part of the music and contribute enormously to the music's rich tapestry. This is a perfect example of a phenomenon that has long fascinated me: There's not a linear correlation between the objective magnitude of a sonic

Constellation has established a benchmark against which all other linestages and power amps can be compared.

difference and the musical perception of that difference. The objective difference in the signal must be vanishingly small between the Constellation electronics and other excellent products, but the musical result of correctly resolving those microvolt signals is profound. It leads to quicker involvement when starting a listening session; the cares of the day or other preoccupations more quickly give way to compete musical immersion. The music commands your attention faster and engages you more deeply. This ability is, I believe, the most reliable indicator of audio equipment quality because it is this state of musical connectedness that is high-end audio's *raison d'être*.

As you might expect given the Hercules' dreadnought design and build, the Constellation electronics rendered dynamics with tremendous authority. For all practical intents and purposes, the Hercules amplifiers are limitless in their dynamic swings. They just sound totally effortless at any listening level, and with any kind of music. With any of the three loudspeakers I heard no hardening of timbres, congestion, or strain even on the most demanding music. This virtually unlimited power delivery, when coupled with the electronics' great delicacy with the quietest musical signals and the absence of noise, set a new standard for me in the rendering of dynamic contrasts.

The overall tonal character of the Altair and Hercules was one of an open, airy, and extended top octave, a very slightly emphasized midband that contributed to the extraordinary palpability, and a bottom-end that favored articulation and pitch definition rather than weight and warmth. The Hercules defies the stereotype that massive amplifiers have big bottom-ends. Although deeply extended and powerful, the bass rendering was not the last word in midbass fullness and heft. This character was a virtue when driving The Sonus faber loudspeaker, with its big, voluptuous midbass, but I would have liked just a bit more weight with the TAD Reference Ones, and to a lesser extent, the Rockport Altairs.

I've described the sonic components of what makes these electronics so special, but it's really the synergy of all of them that contribute to the stunning sense of realism, ease, grace, communication, and involvement that I experienced.

CONCLUSION

Frankly, it's hard to know where to begin in praising the Altair and Hercules. They set a new standard in my experience not just in one or two areas, but in virtually every sonic and musical criterion. It's an easy call to say that the Altair and Hercules are the most transparent, detailed, and cleanest electronics I've heard. They come closer than any linestage and power amplifier I've heard to being completely colorless. The Altair and Hercules sound like whatever source you feed them and whatever loudspeakers you drive. But beyond these specifics, listening to music through these electronics was revelatory.

In addition to this unparalleled musical performance, the Constellation electronics break new ground in features and system control. The Pyxis controller is simply a joy to use. Moreover, the open architecture allows your system to expand, with the new components integrating seamlessly with Pyxis.

Yes, these electronics are shockingly expensive, but I'm thrilled that someone funded the unprecedented development effort and then realized the products with this level of execution. It has shown me what's possible in solid-state design today and established a benchmark against which all other linestages and power amplifiers can be compared. **tas**

INSIDE COST-NO-OBJECT DESIGN AND EXECUTION

These products are packed with cutting-edge engineering never before seen in an audio product. Let's start with the Altair and a crucial sub-system of any linestage, the volume control.

Adjusting the signal level may seem like a trivial proposition, but it is actually challenging to design a sonically transparent volume control. The simplest approach is the venerable potentiometer, a device the subjects the signal to a mechanical contact between the wiper and the electrically resistive material. The audio signal flows through wiper and then the resistive material, which can charitably be described as dirty silicon. The resistive material is infused with impurities that impede the flow of electrons—not the sort of material you want your musical signal traversing.

Here are two examples of how perfectionist audio companies view the potentiometer. Spectral Audio recently spent five years and untold thousands of dollars developing its own potentiometer from scratch, including fundamental metallurgical research and custom spring-loaded wipers. In the second example, Sheffield Lab in the 1970s deemed potentiometers so harmful to the signal that when recording some of their direct-to-disc projects, they resorted to a radical solution. The engineers determined in advance of the session the position of the panoramic potentiometers (pan pots) that adjust a microphone's left-right position in the mix. They then measured the pan pot's resistances and replaced the pot with discrete resistors that matched the pan pot's values. They did this for every microphone input, and had to repeat the process for every session.

An alternative to the potentiometer is the stepped attenuator, in which one of many discrete resistors is inserted into the signal path. The volume control's position determines which resistor is selected. The stepped attenuator replaces the wiper and resistive material with a discrete high-quality (usually metal-film) resistor.

A less expensive implementation of this approach is the MDAC, in which the volume control's position is encoded as a digital code. This digital code then then selects which resistor from a resistor array within a monolithic chip is inserted into the signal path. The resistors in a monolithic chip are inferior to discrete resistors, but this method is far more cost-effective than the often heroic mechanical designs of stepped attenuators.

In a perfect example of Constellation's mandate to the designers to look beyond traditional technologies, the Altair features a volume control that is, to my knowledge, unique in audio. The volume control is based on 48 light-dependent resistors, a two-part device that pairs an LED with a resistor whose resistance is determined by the amount of light impinging upon it. When you adjust the Altair's volume knob, you are changing a digital code that feeds a DAC, whose current output is a function of the digital code driving it. The DAC's current output flows through the LED, with the amount of current flow proportional to the LED's brightness. In this way, a digital code determined by the volume control's setting adjusts the current output of a DAC, which determines the LED's brightness, which determines the resistors' value and thus the audio signal level.

The audio signal is subjected to a discrete resistor, but with no mechanical contacts as with a stepped attenuator. To ensure that the light-dependent resistors are perfectly calibrated, a tertiary circuit measures the Altair's internal temperature and continually re-calibrates the DAC's current flow so that the resistors have precisely the correct value at all times. All this wizardry is transparent to the user, who simply turns what appears to be a traditional volume knob.

This drive to remove mechanical contacts in the signal path extends to the Altair's input switching. The unit has no input-switching relays that route one of the input signals to the preamplifier's circuitry. Instead, an array of light-dependent resistors acts as switches on each input, either opening or closing depending on the amount of light impinging upon the resistor. Unlike the continuously variable changes in the light-dependent resistors' values in the volume control, these input-switching light-dependent resistors are either fully open or full closed.

Even the polarity-inversion switch uses no mechanical contacts. You can hear this for yourself when switching absolute polarity from Pyxis; pushing the polarity button causes the polarity to reverse with no audible glitch—a first in my experience. As far as I know, the Altair is the world's only input-to-output contact-less preamplifier.

In addition to removing contacts from the signal path, Constellation has gone to extraordinary lengths to isolate the audio circuits from vibration and noise. As mentioned earlier, the two halves of the chassis containing the audio electronics are machined from solid blocks of aluminum. Within this 60-pound structure is a shielded sub-enclosure that hangs inside the main chassis on an elastomeric suspension.

The sub-enclosure is made from two non-magnetic steel plates laminated with a polymer sheet between them. This sub-enclosure is then divided into two sub-sub enclosures, with the top half containing the audio signal electronics and the bottom half housing power-supply regulation and the digital electronics that control the light-dependent resistors. This entire "raft" structure "floats" within the massive 8.2mm-thick solid aluminum of the outer chassis. In addition, the mass-loaded, vault-like outer chassis is air-tight. The anti-resonance engineering of this system was designed in conjunction with Michael Latvis of Harmonic Resolution Systems, maker of state-of-the-art equipment racks and vibration-control products. HRS feet are also featured underneath the Altair's chassis.

The audio circuit is fully balanced and built from FETs that are hand-selected for low noise and matched gain. When Constellation found this FET they bought out the manufacturer's entire stock and the manufacturer discontinued the device.

The outboard power supply features three separate R-core transformers, one each for left channel audio, right channel audio, and control circuitry. The umbilical cords connecting the power supply to the linestage use aerospace connectors in which the plug fits into a spiral-wound gold wire, analogous to a "Chinese finger trap." This connection reportedly has virtually no contact resistance. The power supply's output is unregulated; all regulation occurs next to the audio circuits. The Altair features cascaded discrete regulation, with the regulated voltages supplying the audio circuits through solid copper bus bars. ("Cascaded" means that the output of one regulator feeds another regulator for even greater isolation of the DC supply from the AC source. "Discrete" means that the regulators are built from separate transistors rather than integrated circuits.) The result of this heroic power supply design and execution is DC so pure than any noise is down more than 140dB, the limits of the Audio Precision analyzer. (Constellation shared with me the noise plots.)

HERCULES POWER AMPLIFIER

Just as the Altair incorporates innovative, cost-no-object design and execution, so does the Hercules power amplifier. For starters, when the Hercules is driven through the Constellation Direct input, the power amplifier's input buffer is bypassed. Removing this active stage can be realized because the Altair outputs a signal that doesn't need buffering. A second XLR input is available for driving the Hercules with another brand of preamplifier. This input adds an input buffer, which is based on the same topology as the Altair's gain module. Selecting between these inputs is done via a rear-panel control. This system removes an entire active gain stage from the signal path compared with a conventional preamplifier and power amplifier system.

Virtually all push-pull output stages employ pairs of P-channel and N-channel transistors that work together. These designations refer to the transistors' polarity. The P-channel transistor amplifies the positive-going half of the waveform, and the N-channel amplifies the waveform's negative-going half. Unfortunately, P-channel and N-channel transistors exhibit different operation characteristics, specifically the amount of time they take to turn on and to turn off. This disparity results in a waveform discontinuity at the zero-crossing point where one transistor "hands off" the signal to its complement in the pair. Single-ended amplifiers sound so good in part because one device (tube or transistor) amplifies the entire waveform, and thus cannot exhibit zero-crossing distortion.

Constellation has attempted to merge the purity of a single-ended output stage with the high-power of a Class A/B stage. The output stage is built entirely of N-channel transistors, and split into two completely separate amplifiers per monoblock. One amplifier is fed the positive phase of the balanced signal, and the other amplifier receives the negative phase. The two amplifiers in each monoblock "float" (are not referenced to ground) and are connected to each other by the loudspeaker load. This configuration is identical to using two separate amplifiers in bridged mode.

It's well known that low-power models within an amplifier line often sound sweeter and more refined than the more powerful efforts. Constellation wanted to build an amplifier with massive power, yet one that exhibited the delicacy of low-powered designs. It therefore started by developing the best-sounding 125W amplifier it could and, once satisfied with the results, grouped many of these 125W single-ended modules together to achieve the Hercules' 1000W rating. The design is reportedly scalable with no change in sound quality. In fact, the just-introduced Centaur amplifier, rated at 250Wpc, uses two of these modules per channel rather than Hercules' eight. Each module is based on eight output transistors, giving the Hercules a mind-blowing 64 MOSFET output transistors per monoblock. Unlike most power amplifiers Hercules requires no stabilizing inductor on the output; the output transistors are connected directly to the speaker binding posts via solid copper bussbars.

As you might imagine, this gargantuan output stage requires a big power supply and lots of heat sinking. The power supply features dual 3kW transformers with multiple secondary windings. Each transformer supplies one "side" of the output stage. These transformers account for much of the Hercules' 270-pound heft. The heat sinking is readily apparent just by glancing at the Hercules' perforated side panels.

The level of design and execution in the Altair and Hercules is unprecedented. This cost-no-object realization provides an insight into how the world's best designers apply advanced solutions to advancing the audio art.